SCIENCE.

FRIDAY, NOVEMBER 19, 1886.

COMMENT AND CRITICISM.

OUR RECENT CELEBRATION of the two hundred and fiftieth anniversary of the founding of Harvard college seemed to refer us back to the dim past; but that past seems very recent when we read of the celebration in England of the eight hundredth anniversary of the completion of Domesday book. The celebration took the form of a series of meetings for the inspection of manuscripts and literary productions, and for the reading of papers more or less connected with matters affecting the contents of Domesday book. A great attraction was the exhibition of the volumes themselves that compose the Domesday book. The Record office kindly aided by all means in its power the committee having the celebration in charge, and gathered together in one room a vast number of manuscripts and relics. Among these was a document concerning the number of hides in different districts in England, the date of which, as originally written, is placed in the eighth century. Three Anglo-Saxon manuscripts of the eleventh century were exhibited, which showed the method of ploughing. The papers read discussed the history and fortunes of Domesday book as a volume, and its employment as evidence in the courts. There were also some statistical tables read concerning the contents of the book. It is believed that the Royal historical society will issue a full bibliography of Domesday book, including not only printed portions of the texts and separate papers and essays, but also notices of matter referred to by the record.

BY THE DEATH of M. Paul Bert, which was announced on Friday last, France loses one of her most radical and aggressive statesmen, as well as one of her foremost educators and ablest scientific investigators. However much we may differ from some or all of M. Bert's doctrines, we cannot but admire his power, his vigor, and his enthusiasm. Born in 1833, he received a broad and thorough education, becoming a doctor of medicine in 1863, a doctor of science in 1866, and a licentiate in law about the same time. He was for a time assistant to Claude Bernard, and in 1867 was called to the chair of physiology at Bordeaux. In 1869 he was called to the Sorbonne, and became professor of physiology there. After Napoleon's downfall he entered politics, and, after holding several departmental offices, entered the chamber of deputies in 1874 as a representative for Yonne, his native department. He immediately took a prominent part in the debates, and during the discussion of the Ferry law his voice was raised often and vigorously in behalf of lay instruction, compulsory education laws, and the abolition of all school fees. M. Bert was a great friend and admirer of Gambetta, and when that statesman became premier, in 1881, M. Bert was made minister of public instruction in his cabinet. M. Bert's avowed atheism and vigorous radicalism made him many enemies, and he was in no small degree contributory to the speedy downfall of the Gambetta ministry. M. Bert's best-known writings are 'De la greffe animale' (1863), 'De la vitalité des tissus animaux' (1866), 'Revue des travaux d'anatomie et de physiologie publies en France pendant l'année 1864' (1864), 'Notes d'anatomie et de physiologie comparée' (2 vols., 1867–70), 'Recherches de physiologie experimentale' (1877), — crowned by the French academy, — and 'La morale des Jésuites' (1880). At the time of his death M. Bert was governor-general of Tonquin, and minister to Anam, and much was expected from his able and vigorous administration of the interests of France in the orient.

MR. JAMES RUSSELL LOWELL'S great oration at the Harvard celebration calls for notice more special than that which we were able to give last week. Those who had the privilege of hearing the orator report that he spoke with wonderful grace and elegance for almost two hours, holding his audience spell-bound. The oration is in itself a justification of a classical and literary education, and a living argument for a culture loftier and deeper than that which strictly utilitarian theories would provide. Mr. Lowell perhaps overstates himself, but there is more than a kernel of truth in his definition of a university as "a place where nothing useful is taught; but a university is possible only where a man may get his livelihood

by digging Sanscrit roots." Mr. Lowell's generous but just estimate of the vigor, ability, and uprightness of the early Puritans, and his brief but not superficial sketch of the influence of Harvard in the past, will not have escaped the attention of any who have read the oration. Speaking for that class of educated men who, while not behind the times, are not radical, Mr. Lowell uttered some weighty and eloquent words concerning the study of Greek. Speaking of the Greeks, the orator continued, "If their language is dead, yet the literature it enshrines is crammed with life as perhaps no other writing, except Shakspeare's, ever was or will be. It is as contemporary with to-day as with the ears it first enraptured, for it appears, not to the man of then or now, but to the entire round of human nature itself. Men are ephemeral or evanescent; but whatever page the authentic soul of man has touched with her immortalizing finger, no matter how long ago, is still young and fair as it was to the world's gray fathers. Oblivion looks in the face of the Grecian muse only to forget her purpose." Then, too, his description of what a diploma should stand for was exceedingly happy. "Let it [Harvard] continue to give such a training as will fit the rich to be trusted with riches, and the poor to withstand the temptations of poverty. Give to history, give to political economy, the ample verge the times demand, but with no detriment to those liberal arts which have formed open-minded men and good citizens in the past, nor have lost the skill to form them. Let it be our hope to make a gentleman of every youth who is put under our charge, not a conventional gentleman, but a man of culture, a man of intellectual resource, a man of public spirit, a man of refinement, with that good taste which is the conscience of the mind, and that conscience which is the good taste of the soul." In its calm and lofty eloquence, its graceful and pungent diction, the oration was worthy of the occasion that called it forth, and will rank among the masterpieces of American oratory.

Not to be behind the knights of labor, the trades-unionists propose to hold a national council for organization and discussion. The call for the council has been issued to all the trades-unions in the United States and Canada, and the meeting will be held at Columbus, O., on Dec. 8. The basis of representation is to be one delegate from every national or international union of less than four thousand members, two delegates from every union having more than four and less than eight thousand members, and one additional delegate for each additional four thousand members; but no trades-union, not organized for at least three months prior to the session of the convention, can be represented. The call for the meeting sets forth as its objects, establishment of a trades-congress for the formation of trades-unions and the encouragement of the trades-union movement in America; the organization of trades-assemblies, trades-councils, or central labor-unions in every city in America; the founding of state trades-assemblies or state labor-congresses to influence state legislation in the interest of the working masses; the establishment of national and international trades-unions, based upon the strict recognition of the autonomy of each trade, and the promotion and advancement of such bodies; an American federation or alliance of all national and international trades-unions, to aid and assist each other, to secure national legislation in the interest of the working people, and to influence public opinion by peaceful and legal methods in favor of organized labor; to aid and encourage the labor press of America, and to disseminate tracts and literature on the labor movement.

Dr. J. E. Winters of New York, in a paper read before the Academy of medicine, condemned in no mild way the practice, now so common among society women, of employing wet-nurses instead of themselves performing the duties of a mother. He proves most satisfactorily that the practice is not only demoralizing, but actually increases the mortality among infants, and is often the channel through which diseases of a most loathsome nature are contracted. Dr. Winters informs us that Queen Victoria was nursed by her mother, the Duchess of Kent, and in her turn has performed the same office for her nine children. The lives of nine-tenths of the wet-nursed children are purchased at the expense of the lives of other children. The practice, therefore, of placing children to dry-nurse, either in families or institutions, in order that the mother may go as wet-nurse, he regards as iniquitous. He sums up his argument in the following language: "Briefly, then, we usually select a hireling to perform the mother's most sacred duty; one who occupies the lowest place in the social scale, and in whom there is an absence of moral qualities; usually one who has been, in some degree at least, a prostitute; one who can forsake her own child, and take a

stranger's to her breast; one who can witness the gradual starvation and death of her own child, and who may be a double murderess by poisoning her foster-child with opiates or alcohol. If, after being nourished from such a fountain, our child is perverse, froward, insolent, and has no regard for truth, who is accountable? Is not the mother, who deprived him of her own pure, untainted breast, and who purchased for him instead a polluted and debauched stream?" It is lamentable that a system so pernicious and injurious to the best interests of society should be tolerated, and even encouraged, by the most eminent and honorable members of the medical profession. Dr. Winters deserves the thanks of all right-minded persons for the able and convincing manner in which he puts his arguments, and it is to be hoped, that, attention having been thus directed to what may be regarded as a great and growing evil, this abominable practice which he so justly condemns may be, to some degree at least, mitigated and lessened.

IT APPEARS TO US that the New York county medical society, in its efforts to prevent quackery, is in danger of estranging many members of the medical profession who have thus far given it their cordial support. The law of 1880, requiring the registration of physicians in the office of the clerk of the county in which they intend to practise, would not have been enacted without such opposition as would in our judgment have been fatal, had it been known that regular physicians, whose professional attainments were unquestioned, would be arrested and imprisoned, if, having registered in one county in the state, they should commence practice in another county without registering again. And yet this has been done in the case of a regular graduate of medicine, who, having practised for eight years in Richmond county, removed to New York City, and entered practice there, neglecting to register his name anew. It is absurd as a matter of common sense that registration in one county should not be sufficient, rather than that a man should be required to register in all the counties of the state if he desired to practise in them; and, as appears from an unwritten opinion given by two judges of the supreme court of this state, it is equally absurd as a matter of law. As a matter of fact, the practice seems to vary in the different counties, the clerk of Kings county refusing to allow the re-registration of a physician who is already registered elsewhere in the state. In the case to which we refer, where a physician was prosecuted by the county society, we understand he has brought a suit against the counsel of the society who caused his arrest, for damages.

THE STATISTICS RELATING to the defective, dependent, and delinquent classes collected in the tenth United States census, and prepared for publication by Mr. F. H. Wines, editor of the *International record of charities and correction*, have been ready for the press for more than two years. But the reduction of the clerical force of the census bureau seemed to postpone their publication indefinitely. Senator Cullom of Illinois, however, came to the rescue, and on his motion the senate called for them, and ordered them printed as a senate document. It is hoped that they will be given to the public early in 1887. This suggests the reflection that the newly elected congress will probably be the one which will have to make provision for the taking of the eleventh census, and it is not businesslike to have the publications of one census stringing along in a go-as-you-please way until the time for the next census comes round.

WE HAD OCCASION, in a recent number of *Science* (p. 433), to refer to a new treatment for consumption, consisting in the inhalation of bacteria in the form of spray. Another method of treatment which is now attracting the attention of physicians is by injecting remedies directly into the lungs by means of the hypodermic syringe, the needle of which is passed through the wall of the chest, the effort being made to apply the medicinal agent as nearly as possible to the affected portion of the lungs. Some very encouraging cases are reported, in some of which the improvement has been so great as almost to justify one in speaking of them as cures. Carbolized iodine appears to have produced the best results, causing the complete cessation of cough and expectoration, and the further progress of the disease.

A CIRCULAR ISSUED by the chief signal officer, under date of Nov. 10, announces that on March 1, 1887, a new system of weather-signals will be adopted for general use at local and volunteer display stations. The new system is based on the one in use in Alabama, and designed by Professor Mell, director of the Alabama weather-service: it is of four flags, — a square white flag, for clear or fair weather; a square blue flag, for rain or snow;

a triangular black flag, for temperature, to be hoisted above the other flag for higher temperature, below for lower temperature; and a square white flag, with square black centre, for a cold wave, as at present. When suspended from a horizontal pole or rope, a small white streamer will be used to indicate the end from which the flags are to be read. This system of signals is superior to the Ohio system, — red and blue, sun, star, moon, — now in general use, by reason of its simplicity, visibility, and cheapness; and the absence of red among its colors removes the objection that many railway managers have felt to the display of the other signals on the sides of cars.

THE FALL MEETING OF THE NATIONAL ACADEMY.

The semi-annual meeting of the National academy of sciences was held Nov. 9–11, 1886, in Boston. By the kindness of the Massachusetts institute of technology, the academy was accommodated in its spacious buildings on Boylston Street. More than half the members of the academy were present, the number being larger than usual, owing to the interest taken by many in the two hundred and fiftieth celebration of the founding of Harvard college, which event was celebrated on the preceding days. The only business of general interest related to the publication of the annual volumes of memoirs. The president announced that the text of vol. iii. was nearly all printed, and that authors are cautioned to see that the manuscript and illustrations are always in proper shape, and complete for the printer when handed in to congress early in December of each year, as otherwise they are likely to be rejected. Of the scientific papers read, a full list of which is given on another page, we note the following:—

S. P. Langley, in a paper on 'The solar-lunar spectrum,' stated that for some years past we have suspected, but never actually been able to demonstrate, the existence of radiations from the sun of wave-lengths greater than three microns, and have been in doubt whether our atmosphere had entirely absorbed these if they really existed, or whether they were absorbed already in the sun's atmosphere and never reached ours at all. He has during the last year shown that the former hypothesis is more probable, and that the trouble lay partly in the fact that the terrestrial absorption here was almost total; partly in the apparatus, wherein diffused solar radation of shorter wave-lengths entirely obscured the almost infinitely feeble portion of these longer waves, which our atmosphere had in fact transmitted. By the use of very perfect rock-salt trains, and by an elaborate device for sifting out extraneous radiations, he has now been able to show the existence of certain of the longer solar waves, even down to the extreme length of seventeen microns, to which waves lamp-black is as transparent as glass is to the shorter or light waves. This selective absorption of lamp-black has been before surmised, but its existence to this degree is a new fact. On examining the radiation of the moon, Langley finds, in spite of the feeble heat, some of these long waves more easily distinguished than in solar radiation, owing to the fact that in the case of the moon, whose radiation, he observes, is mainly dark heat of these very great wave-lengths, he is not troubled with the enormous disturbances due to the diffusion of the intense shorter waves in the case of the sun. He states then that there is found, by the aid of the rock-salt trains, a minute amount of solar heat between three and five microns, below which the cold bands which have been growing closer and closer, and letting less and less heat between them, practically coalesce into one almost unlimited cold band, extending to eleven microns; and that probably the earth's atmosphere absorbs practically all the solar radiation between five and eleven microns, and, indeed, beyond; except that there is one band of most feeble transmission from this point to about sixteen microns. This transmission is here so feeble that the energy of the strongest radiations in this latter part of the normal spectrum is less than one one-thousandth of that in the visible region, and the total radiation here even less in proportion to that in regions already known.

These new researches, then, while enlarging the extent to which the solar infra-red spectrum has been examined, to the great probable length of over seventeen microns, and while confirming the previously announced fact that almost no solar heat reaches us in this region, are chiefly interesting in their bearing on the question of the transmissibility of our atmosphere, and as showing that its apparent action in allowing lunar heat to pass where no solar heat was found is consistent with the possible existence of the latter, outside our atmosphere, of every wave-length. Professor Langley's researches on lunar heat are not completed, but he announced the conclusion as probable that the temperature of the moon's sunlit surface is neither as high as assumed by Lord Rosse nor as low as he himself was once inclined to think, and probably may be little higher than that of melting ice.

T. Sterry Hunt read a paper on 'A basis for chemistry.' Herein he resumed the conclusions of a series of papers on chemical philosophy from 1848 to 1886. He defined chemical changes as interpretation or differentiation resulting in new species; distinguished in the chemical process metagenesis and metamorphosis, the latter embracing homogeneous changes only; sought to define the limits between chemistry and dynamics, and to exclude the atomic hypothesis from the former; discussed the genesis of chemical species from a primal element; maintained that not only solution but fusion, solidification, volatilization, and condensation are chemical processes, liquid and solid species being polymers of their respective vapors; and showed that the law of homologous or progressive series extends to mineral species, as oxides and silicates, which are not only of high equivalent weights and complex formulas, but are polymers whose degree of condensation it is possible to fix. The values got by dividing the received equivalents (hydrogen being unity) by the density (water being unity) represent, not the volumes of molecules, but the contraction in passing from the gaseous to the solid or liquid state, being the reciprocals of the coefficients of condensation. Water, whose density at +4° is 1.000 (being formed by the condensation of 1,628 volumes of steam at 100°, with an equivalent weight of 17.9633, to a single volume at the same temperature), has itself an equivalent weight of 29.244 instead of 29.304 (which corresponds to $H_2O = 18$), as given by the author in *Science* for Sept. 10, 1886. From this figure the equivalent weights of all spheres whose specific gravities are known may be calculated; the law of volumes being universal, and extending alike to gases and vapors, to liquids and solids.

F. W. Putnam, in a paper on 'Archeological explorations in the Little Miami valley,' illustrated by elaborate drawings and photographs, showed that the exhaustive method adopted during the past five years is the only one that can possibly give results of any value relative to the early occupants of this continent. Professor Putnam's researches show that there have been at least two types of people, — first, those whose graves are the so-called ash-pits; second, those who built great mounds over the remains of their chiefs and great leaders, while the mass of the common people were buried in trenches lately discovered by him. Both these occupied the central regions, and were spreading northward when they were met and overthrown by the Indian races of modern times, who have spread from east to west. Professor Putnam's paper was but a small selection from the large volume now preparing by him.

E. C. Pickering read a paper on the 'Draper memorial photographs,' in which he stated that photographs of the spectra of the stars had been studied by himself first with a small telescope, the exposures lasting generally five minutes, next with a larger telescope, and finally with the magnificent eleven-inch glass belonging to Dr. Draper, and loaned by his widow, in front of which are placed two wedges or prisms of glass eleven inches square, and whose construction must be considered as the greatest triumph hitherto attained by the opticians. With this latter apparatus, which has now been in operation only a few weeks, photographs of the stellar spectra have been made by exposures of from five minutes up to one hour. The bright and dark lines in these photographs, as shown by high magnifying powers, are to be counted by hundreds testifying to the wonderful perfection of the optician's work, and give us for the first time assurance that the problem of the movement of the fixed stars to and from the earth can now be attacked with hopes of success. By means of the lantern, Professor Pickering showed upon the screen the result of some of his most recent photographs, among them the entire group of the Pleiades, in which the agreement among the spectra of certain stars strongly confirmed the results announced by Dr. Elkins as to their physical connection.

C. Abbe, in a paper on 'The question of barometer exposure,' stated that the influence of the wind upon the barometer is not a new question, but has long since been recognized as an important matter. Its actual treatment had, however, been so difficult as to lead to its neglect. This is one of a series of difficult questions in aerodynamics which are intimately connected with each other. For instance: the rain-gauge is an obstacle to the wind; the currents about its mouth deflect the rain; the proper gauge must be so constructed that there shall be no currents about its mouth; the best gauge has the least deflection. On the other hand, a cowl on a chimney-top to increase the draught or ventilation is an obstacle to the wind, so arranged that it shall give the greatest disturbance: its province is to diminish the static pressure at the top of the chimney, and allow the static pressure in the room below to push the air upward. Elaborate experiments on this subject were made in Boston in 1848, and the apparatus is still preserved by the chairman of the committee, Dr. Morrill Wyman: illustrations of their results were given by the author. The problem of measuring the force of the wind is very distinct from that of measuring the velocity, since the force varies with the shape of the obstacle and its size. Illustrations of

various apparatus and results were given. If now a barometer could be carried along with the wind, it would indicate the static pressure within that mass of moving air; but as soon as the barometer is fixed, it, or the building within which it is contained, becomes an obstacle, and a dynamic effect is added to the static pressure. A barometer on the windward side of an obstacle gives too high, and on the leeward side too low, a result. Our only practicable method of determining the static pressure is to measure these two compound results relative to any obstacle, and then from theory or experiment obtain a third relation between the two dynamic effects, whence by elimination we find the separate items. The author showed the application of this idea to the apparatus of Pitot, Darcy, Arson, and, further, that the simplest solution consisted in exposing a sphere as the obstacle, and measuring the pressures shown by barometers that are connected by small tubes with the windward and leeward sides of the sphere, the sphere being chosen as one of the few bodies whose stream lines have been satisfactorily determined by mathematical analysis.

Alfred Russell Wallace read a paper on 'The wind as a seed-carrier,' in which he stated that he would by request submit some ideas and ask for data in relation to the ability of the winds, to explain the known distribution of plants. He stated that a large number of arctic plants are now widely distributed throughout the southern and northern hemispheres, so that plants living in New Zealand, Australia, and extreme southern America, are nearly identical with those in high northern latitudes, as also with those found on the high mountains of temperate zones. These occurrences might be explained by the glacial epoch, as Darwin suggested, but that no such glacial epoch is known to have occurred in the torrid zone. His own studies on the fauna of the islands of the ocean had shown that a single occurrence, under favorable auspices, could explain the introduction of a new species in any out-of-the-way place, as illustrated by transfers of seed by sea-currents, by birds in various ways, by human agencies, and especially by the wind. Strong winds carry the heavier seeds short distances, and drop them, to be lifted up and carried again on some future occasion; but the lighter seeds, when once elevated, fall so slowly that even a moderate wind will carry them to great distances. In this way the arctic fauna may be easily transferred toward the torrid zone, and possibly an occasional storm (even one in a century will suffice) may transfer the seeds across the equator, so as to initiate the spread of the same species in the southern hemisphere.

THE HARVARD CELEBRATION.

Two hundred and fifty years ago on the 7th of November, 1636 (new style), the great and general court of the Massachusetts Bay colony agreed to give four hundred pounds towards a college or school. That vote was the founding of Harvard university,— a foundation which was, to use Mr. Lowell's words, "a quite unexampled thing." "Surely," he added, "never were the bases of such a structure as this has become, and was meant to be, laid by a community of men so poor, in circumstances so unprecedented, and under what seemed such sullen and averted stars. . . . The prevision of those men must have been as clear as their faith was steadfast. Well they knew and had laid to heart the wise man's precept, 'Take fast hold of instruction; let her not go, for she is thy life.'"

The anniversary exercises began on Friday, when the law school alumni listened to an address from Oliver Wendell Holmes the younger, and then dined together. Saturday was devoted to the undergraduates, — literary exercises and a boat-race in the morning, with a foot-ball game in the afternoon. The torch-light procession assigned for the evening of this day was postponed to the following Monday. Sunday the true anniversary of the foundation was divided between two services in the college chapel, in which Presidents Dwight and McCosh assisted Phillips Brooks and the university pastor, F. G. Peabody. Sandwiched in, as it were, between these sacred services, was a concert by the Boston symphony orchestra.

But Monday was the interesting day, the most notable event of which was the splendid oration delivered by James Russell Lowell, a graduate of and a professor in Harvard college. The theme was one to inspire any orator, and what an audience was gathered to hear him! The alumni were out in force, and filled every nook and corner of Sanders theatre, while on the platform was an assemblage of distinguished men such as one seldom sees. First and foremost among the invited guests was the President of the republic; and the enthusiasm with which Mr. Cleveland was greeted showed that Harvard men appreciate true manliness. With him were Secretaries Bayard, Lamar, and Whitney, while Endicott occupied his chair as a fellow of the corporation. When the conferring of honorary degrees was reached, the name of Lamar was found to be second on the list, and the demonstration which greeted the announcement was very marked. Among educators should be mentioned the delegate from John Harvard's college, Emmanuel, and from his university, Cambridge. In truth,

Cambridge was the mother of the New England university, while from Emmanuel came many of the most illustrious of the founders of Massachusetts. College presidents, too, were numerous; among the rest, Dwight of Yale, Gilman of Johns Hopkins, Angell of Ann Arbor, McCosh of Princeton, Adams of Cornell, and the youthful head of old Bowdoin, William De Witt Hyde, of the Harvard class of 1879. The degree of doctor of laws was conferred on most of those who had not already received it, and also on Leidy of Pennsylvania, Charles Deane of Cambridge, and Gildersleeve of Baltimore.

Mr. Lowell's oration contained that happy mixture of wit and scholarly wisdom so essential to an interesting address. As an example of this, was the remark that the college buildings, unlike those of the old country, never looked old, and never would. "Time refuses to console them," he said. "They all look as though they meant business, and nothing more. And it is precisely because this college meant business, — business of the gravest import, — and did that business as thoroughly as it might with no means that were not niggardly, except an abundant purpose to do its best, — it is precisely for this that we are gathered to-day." Further on, after describing the Puritan society of the early time, Mr. Lowell said, "It was a community without charm, or with a homely charm at best, and the life it led was visited by no muse, not even in dream; but it was the stuff out of which fortunate ancestors are made, and twenty-five years ago their sons showed in no diminished measure the qualities of the breed." But the portion that aroused the most enthusiasm was at the close, when he referred to the President of our country. "We have no politics here," he said, "but the sons of Harvard all belong to the party which admires courage, strength of purpose, and fidelity to duty. . . . He has left the helm of state to be with us here; and so long as it is intrusted to his hands, we are sure, that, should the storm come, he will say with Seneca's pilot, 'O Neptune, you may save me if you will, you may sink me if you will; but, whatever happens, I shall keep my rudder true.'" Coming after this oration, Dr. Holmes's poem proved disappointing to many.

In the afternoon the alumni dined in the great hall, and, after satisfying the inner man as well as they could, they listened to more speeches. Especially deserving of remembrance was that of President Angell of the University of Michigan. In brief he declared that all American colleges were indebted to Harvard for "her brave experimentations in college and university problems. . . . Especially under the present vigorous administration, there have been such exhaustive study and such courageous experimenting, that the excitement and stir have reached the remotest country college and the most secluded village academy. . . . This has made an epoch. Never before did the college and the people get so near together. Those who do not accept the doctrines in favor here, and those who do, are alike indebted to you, for we have all been stirred."

While the men were thus passing their time, Mrs. Eliot was introducing Mrs. Cleveland to the ladies of Cambridge. In the evening a public reception was held in the Hemenway gymnasium, and the festival so happily conceived and so admirably conducted was brought to a close. Indeed, perhaps not the least fruitful part of the whole celebration were the social relations which were begun or continued in the hospitable parlors of the college town.

NOTES AND NEWS.

THE semi-annual meeting of the trustees of Princeton college last week was the occasion for the presentation of a report on the state of the college by President McCosh. This year the college has more students than any previous year in its history. Eighty-nine graduates are attending classes, fifty of whom follow Dr. McCosh's lectures on contemporary philosophy. The trustees adopted a scheme similar to that in operation at Amherst and Harvard, by which the students choose a standing committee to represent them in conferences with the faculty. This plan goes into effect at once. The plans of President McCosh looking to the transformation of the college into a thoroughly equipped university were listened to with approval, and referred to a special committee consisting of the standing committee on curriculum and two other members of the board of trustees.

— The following is a complete list of the papers entered to be read before the National sciences academy at the recent session in Boston, Nov. 9–11: S. P. Langley, The solar-lunar spectrum; T. Sterry Hunt, A basis of chemistry; Alpheus Hyatt, Primitive forms of Cephalopoda; Alpheus Hyatt, A case of evolution in the migration of forms; Alpheus Hyatt. Lituites of the limestones of Phillipsburg, Canada; F. W. Putnam, Archeological explorations in the Little Miami valley, Ohio, conducted by F. W. Putnam and C. L. Metz; E. C. Pickering, Draper memorial photographs; E. D. Cope, On lemurine reversion in human dentition; E. D. Cope, On the columella auris of the tailed Batrachia; Edw'd S. Morse, Change in Mya since the pliocene; A. S. Packard, The cave

fauna of North America, with remarks on the anatomy and origin of blind forms; C. H. F. Peters, A chart of the stars in the group Præsepe; C. H. F. Peters, A catalogue of stars from positions in various astronomical periodicals; O. T. Sherman, A catalogue of bright lines, observed in the atmosphere of β Lyrae; W. L. Elkin, On the relative motions of the Pleiades group deduced from measurements made with the Königsberg and Yale college heliometers; C. A. Young, Some observations with Pritchard's wedge photometer; C. Abbe, The question of barometer exposure; G. W. Hill, On the construction of new tables of Saturn; R. Pumpelly, On the relation of the Green Mountain rocks to the Taconic; T. Sterry Hunt, Hardness and chemical indifference in solids; Alfred Russell Wallace, On wind as a seed-carrier in relation to one of the most difficult problems in geographical distribution; W. M. Davis, The mechanical orgin of the triassic monoclinal in the Connecticut valley.

— The committee having in charge the presentation to Prof. Edward Zeller of Berlin, as a commemoration of the fiftieth anniversary of his attainment of his doctorate, of the bust of the celebrated historian and philosopher himself, moulded by Professor Schaper, met and presented the bust to Professor Zeller on Oct. 31. On the long list of subscribers to the commemoration are a number of English and American professors and students of philosophy, among them those of President Angell of the University of Michigan, Professor Bain of Aberdeen, President Bascom of the University of Wisconsin, Professor Burt of Ann Arbor, Dr. Nicholas Murray Butler of Columbia college, Prof. Edward Caird of Glasgow, Prof. G. H. Howison of the University of California, Prof. T. H. Huxley of London, Prof. Benjamin Jowett of Oxford, Prof. George T. Ladd of Yale college, Dr. James Martineau of London, Prof. George S. Morris of Ann Arbor, Prof. George H. Palmer of Harvard college, Prof. W. H. Payne of Ann Arbor, ex-President Noah Porter of Yale, President Robinson of Brown university, Prof. J. G. Schurman of Cornell university, and Prof. C. W. Shields of Princeton college.

— *Appalachia*, vol. i. No. 1, has been republished, and copies will be furnished by the sales-agents, W. B. Clarke & Carruth, Boston, Mass.

— The London literary journals announce that two interesting manuscripts have lately been presented to the British museum by her majesty's consul at Chungking, China. The larger of the two fills seventy-three folios, and is in the Lolo character, being written in verse of five characters to a line. The smaller one is of thirteen folios, and is in the writing of the Shin-kia, a Shan tribe of the southern portion of the province Kwei-chow. This is the first specimen of the writing of this tribe to reach Europe. The characters are adaptations of contracted forms of an early kind of Chinese writing, with an admixture of pictorial signs. The work is one on divination, each sentence closing with words of good or evil augury.

— Previous to 1879 typhoid-fever was very prevalent in Vienna, Austria. At that time the drinking-water was the water of the Danube. In that year a new source for the city's water was drawn upon, and since then the disease has very much decreased.

— The citizens and authorities of Chicago are very much interested at the present time in the solution of the problem of preventing the further contamination of the water-supply of that city. The plan which seems to promise the best results is to divert all the sewage from the lake to the river, and to pump from the river into the canal 12,000 cubic feet per minute for every 1,000 of the population. The report of Dr. Rauch, submitted to the Illinois state board of health at its last meeting, shows that by the adoption of such a plan the water of the lake would be in all respects adapted for domestic purposes, and would be entirely free from contamination, while at the same time no contamination will result in the water of the river at points where other cities take their water-supply.

— The Russian government is about to have constructed a petroleum pipe-line, with a capacity of 160,000,000 gallons of oil a year, extending from Baku, on the Caspian, to the Black Sea, a distance of about six hundred miles.

— Mr. Daniel G. Brinton has been elected professor of American linguistics and archeology in the University of Pennsylvania.

— A lady aged sixty-two had for many years suffered from neuralgia of the face and ear, and had also had an abscess form in the right ear. She subsequently contracted what she supposed was a severe cold in the head, and, while blowing the nose forcibly, expelled what proved to be a wisdom-tooth. She remembered that some thirty years before, she had suffered from 'cutting a wisdom-tooth,' but she was at that time relieved without the appearance of the tooth. It doubtless found its way upward into the upper jaw, and finally liberated itself by ulceration through the nose in the manner described.

— From a series of experiments by Zott, of

Munich, it would appear that gold-beater's skin is a much better dialyzer than parchment paper, so extensively employed for that purpose in chemical and other laboratories. Taking gold-beater's skin as the unit, Zott ascribes the following figures of effectiveness to the substances named: gold-beater's skin, 1: sow-bladder, 0.7; parchment paper, 0.5; leather 2 mm. thick, 0.02; caoutchouc, 0.001. Porous earthenware cells, employed as dialyzers, are but one-sixtieth as effective as gold-beater's skin.

— T. B. Stowell, Ph.D., in a paper read before the American philosophical society, has given in a most concise and thorough manner the anatomy of the trigeminous nerve of the domestic cat. Dr. Stowell has in this contribution to comparative neurology cleared up many points which have hitherto been obscure, and has thus indirectly been of great service to students of human physiology. His paper on the vagus nerve in the same animal, read before the same society some years ago, was equally valuable, and together they will have an important bearing on the future of neurological science.

— Professor Vogel calls attention to the effect upon plants of growing them under unnatural conditions. He states the hemlock does not produce conine in Scotland, and that the cinchona plants will not yield quinine when grown in hot-houses. He finds that tannin is produced in greatest quantity in those which have had a full supply of direct sunlight.

— Dr. Shoemaker of Philadelphia records in the *Therapeutic gazette* his experiences under the influence of ether. In the first period, which was brief and without excitement, he was able to ask a rational question about the sheet with which he was to be covered; but immediately thereupon control over the vocal apparatus was lost. Of this he was conscious. Then came the second or unconscious period. Throughout this time there was present the single impression of "two endless parallel lines in swift longitudinal motion, each line being deflected at a certain point to form a wave." All this was set on a misty background, showing little of the lines at once, though the lower line was clearly moving from left to right. The lower line gave ascending waves, which intersected with the descending waves of the upper line. There was also a low but distinct, constant whir, as if due to the running lines. These lines occupied the whole mental field. There were no visions, no dreams of past experiences, not even a conception as to what being it was that was regarding the two lines, or that there was any such being. All trace of personality was gone. Then the lines began to move irregularly; the patient drew a deep breath; it dawned upon him that *he* was looking at the lines, and the third period (of recovery) was begun. Then came, in an order which could not be remembered, a series of curious impressions. He felt that he had glimpsed the essential nature of human existence. The lines were the existence of the soul, of his soul; and the waves were his animal life, and were thus a temporary modification of a primary condition. The idea was felt to be new and important, and ought by all means to be remembered. But the attempt was in vain; there was a spiritual power controlling him and preventing it. Though an unimaginative man, it took days to shake off the feeling that another phase of existence had been revealed.

— The accompanying cut illustrates a meteorological observatory for automatic instruments, erected by Mr. W. H. Childs last May on Mount

Wantastiquet, over the eastern side of the Connecticut River, opposite Brattleboro', Vt. It is 1,060 feet above the river, or about 1,500 feet

above sea-level. The wind-vane turns the pointer on the dial (seven feet in diameter) so that the wind-direction can be read with a glass from the town below. The Robinson anemometer is connected by wire with Mr. Child's office, where it has made continuous record since June 1. During the summer, there has been a Draper thermograph belonging to the New England meteorological society inside the shelter, and a corresponding instrument belonging to Mr. Childs in the town below. Next summer it is proposed to add self-recording instruments of the Richard-frères pattern. During the winter, the weekly ascents of the mountain, required for attention to the thermograph, have to be given up.

— M. Meguin claims to be able to determine the date of death by studying the generations of Acarina which have been at work upon the body. Brouardel produced the cadaver of a young woman before the French academy of medicine, which had lain in a cellar for a year. He was able to trace five different species of Acarina, and the order of succession and duration of each species. He found dermestes sarcophagus, laticrus, and lucina cadaverina. One species consumes the fatty acids, another absorbs the fluids, and each dies when its work is ended. The period of life of each in summer is from six to eight weeks. In a case of murder in which the remains of the victim were discovered in a garden, Meguin was able to establish the date of burial with great accuracy. The value of these observations and deductions, if confirmed, cannot be overestimated, as hardly a month passes without the discovery of a murdered body, and in the course of the prosecution the probable date of death is always an important factor. So far as we know, no one has taken up this work of Meguin, Brouardel, and Laboutbene in this country, and yet it would seem that no field offers more inducements to the medico-legal expert than the one just opened by these enterprising French *savants*.

— Dr. Lemuseau, in *Le moniteur du practicien*, gives a *résumé* of the progress made in the examination of blood and its detection during the last fifty years. At the present time there are four methods employed for the determination of the presence of blood. The first is that by means of the haematine crystals, due to Teichman, and improved by Struve and Morache. The second method is spectroscopic examination. The third is that of Taylor, consisting in the employment of tincture of guaiacum, which, combined with the essence of turpentine or ozonized ether, yields a beautiful blue color if blood be present. The fourth is microscopic examination. In reference to the possibility of determining whether a given specimen of blood is human or not, Vibet says it remains impossible to assert with positiveness that a blood-stain is formed of human blood. It is in certain cases only admissible to say that it may be caused by human blood. Sometimes it can be affirmed that the stain is of the blood of some other kind of mammalia, but not of man; but in order to justify this opinion it will be necessary that the blood-corpuscles of the alleged animal be much smaller than those of man.

— Dr. Tipton of Selma, Ala., in the *Sanitarian*, gives some very interesting facts and figures, the result of his life among the blacks of the south. He claims that their death-rate exceeds their birth-rate, the mortality being 30 per 1,000. While during the slave state consumption was practically unknown, now it is the principal factor in the diminution of the race. One-half the male population is syphilitic, and most of the women have uterine disease. Hysteria, rheumatism, and alcoholism are common. If Dr. Tipton's opinions are correct, it is only a question of time when the whole race becomes extinct, unless by intermarriage with the whites the otherwise inevitable result is altered. Even this will but postpone the blotting-out of this people, if disease prevails to the extent indicated.

— Lieutenant Yate, who accompanied the Anglo-Russian boundary commission as a correspondent, has in press a book entitled 'England and Russia face to face in Asia.' It will describe the work of the boundary commission, the topography of the country, and the character of the native tribes. Lieutenant Yate is expected to throw new light on what the diplomatists unite in calling the 'affair' at Penjdeh.

LETTERS TO THE EDITOR.

The teaching of natural history.

In the last number of *Science* 'A teacher' complains rather bitterly of your review of French's 'Butterflies,' and adds some comments on methods of instruction in natural history. I have never had any experience as a teacher, but the method of teaching natural history has too much influence on the future growth of that science to fail to interest any naturalist, even if he be unconnected with a school or college.

Without now inquiring whether the demand expresses what is best for the advancement of knowledge, it seems to me that the actual demand of teachers and learners in entomology in this country is for a handbook of some group of insects on some such plan as is followed in Gray's 'Manual of botany,' in which, by analysis and by the characterization of each category of groups, the *relative affinities* of the objects under treatment are throughout brought to

view. That Gray's 'Manual' is often used for the mere determination of names of plants does not interfere with this its higher and primary use. This distinction 'A teacher' seems to ignore. If he will call to mind that it is not from finding out mere names of objects, or giving them, but from weighing and discussing the nature, meaning, and causes of the relative affinities of organized beings, that the whole philosophy of natural history has arisen, he will perhaps agree that it is not best to teach pupils to think that they have gained the least knowlege of nature, when they merely know what their elders name a given object. The name may be called a necessary evil; and unless, with it, is more emphatically acquired a knowledge of the structural and biological relations of the object which it bears to other objects, it is worse than useless knowledge. This idea should underlie every manual for instruction.

SAMUEL H. SCUDDER.

Coloring geological maps.

Having occasion recently to have printed a miniature geological map of Indiana, I endeavored to use the colors recommended by the International congress of geologists. Supposing that my endeavor might be more or less suggestive to those interested in the subject, I sent specimens of the map to the members present at the Berlin meeting of the congress, and with them a letter in which I pointed out the difficulties I had encountered in using these colors. I am indebted to Dr. Persifor Frazer for calling attention to my oversight in using them. My apology is, that I selected the colors from the specimen sheet printed in Berlin, and sent out with the American committee's report of the work of the congress. This sheet is entitled the "*Gamme des couleurs (provisoire) pour la carte géologique internationale de l'Europe.*" Upon it the colors for the Devonian are for its three subdivisions, while no colors or modifications of colors are given for subdivisions of the subcarboniferous, and no reference is made to explanations elsewhere. On its face this sheet claims to be complete in itself.

Had I referred, as I see that I should have done, now that Dr. Frazer calls my attention to the matter, to the report of the international committee, and then again to the proceedings of the congress, to ascertain whether or not certain recommendations of the committee were adopted, I should have found that my difficulties had been anticipated, and should have saved myself the trouble of mentioning them. It seems to me, however, that the very fact that such a process is necessary — that one cannot safely use this color-scheme without explanations other than those to be found upon the sheet — is evidence that this system is not all that one might reasonably expect.

As to the purpose of the scheme, I supposed from the first that it was intended for geology the world over; but, after my maps were partly printed, a member of the American committee, to whom I mentioned my difficulty, suggested that these colors were intended only for European geology, and called my attention to the title of the specimen sheet given above.

Dr. Frazer seems to think it unreasonable to expect any system of colors to give entire satisfaction on so small a map. I have no fault to find with the international system on this score, especially as the geology of Indiana is very simple.

The difficulty in subdividing the carboniferous does not come from the scale of the map, but simply from the absence of any fixed method of indicating the subdivisions. To be sure, geologists are left to differentiate as they choose, provided they all use gray; but I may use one method, and another person may use a very different one, the result of which is the absence of uniformity; and uniformity, I take it, is the prime object of a color scheme. In such cases the subdivisions require explanations. My idea of a universal color-system is, that, once introduced, it would need no explanations.

The report of the committee upon the map of Europe suggests that in such a case as the one I refer to in the letter sent out, when the terrane is of a known system, but unknown subdivisions, an initial letter be used in connection with the mean shade of color.

If, instead of colors, we are to use letters, I submit whether we can fairly call such a method of representation a *color* scheme.

JOHN C. BRANNER.

Bloomington, Ind., Nov. 10.

Butter and fats.

Science (Sept. 10, p 223) says: "Dr. Thomas Taylor's microscopic method for detecting the adulterations of butter with foreign fats seems destined to assume as many shapes as Proteus." Were this even so, it should not excite surprise, considering that about sixty different compositions have been secured under United States patents for butter substitutes, from which it will be seen that oleomargarine has itself become a veritable 'Proteus.' *Science* further says: "At first the globose forms obtained by the boiling and subsequent slow cooling of butter, and exhibiting the Saint Andrew's cross under polarized light, were brought prominently forward as distinguishing marks of pure butter." Answer: What I have stated is, that, when pure butter is boiled, cooled, and viewed as described, globose bodies (butter crystals) appear, exhibiting the Saint Andrew's cross, a fact not now disputed; that lard similarly treated yields a crystal, spinous, without cross; that beef-fat gives a branched and foliated crystal, without cross, — all of which Professor Weber admits, summing up the results of his first three experiments in the following words: "Thus far the results and statements of Dr. Taylor are fully corroborated."

If, however, *Science* intends the inference that I have represented that globose bodies with cross, discovered in any butter-like material when boiled, is a proof that said material is butter, I have only to say that no such idea has ever been entertained by me, or published over my signature. If the inference is intended that the discovery of the butter crystal and cross has some relation to my method of distinguishing oleomargarine from butter, nothing could be farther from the truth. My method of distinguishing oleomargarine from butter consists simply in demonstrating that certain forms of fatty crystals not known to pure butter are constantly found in oleomargarine; and in order to accomplish this, I examine the suspected material, as found in the market, unboiled. By this means I can generally detect at once the lard or other foreign fats, if the material is an oleomargarine. It is manifest that the Saint Andrew's cross found in pure butter would not help me to discover crystals of lard in oleomargarine.

But *Science* says, 'at first.' Am I to understand by the words 'at first' that when I, for the first time, announced publicly that I could detect oleomargarine, it was owing to my discovery of the globose crystals of butter showing the Saint Andrew's cross? If such is the meaning intended, nothing could be more erroneous. I did not discover the Saint Andrew's cross until May, 1884, while the record shows that from July, 1879, until May, 1884, I was determining between butter and oleomargarine by the simple method described. Other helps were sometimes employed, such as testing by acids, boiling to get the odor of butter or other fats, etc.; but I have always considered the presence of highly developed fatty crystals in the material conclusive evidence that the substance is oleomargarine.

In a communication to Hitchcock and Wall's *Quarterly microscopical journal* (vol. ii. July, 1879), published in New York, I set forth, among other statements about butter and oleomargarine, that I was able to detect the latter, owing to particles of cellular tissue, microscopic blood-vessels, and stellar crystals of fat found in it. This paper is illustrated with several cuts, exhibiting respectively the stellar crystals and portions of adipose tissue.

In a bulletin of the microscopical division of the department of agriculture, published in 1884, by direction of Commissioner George B. Loring, a paper of mine appears, with six chromo-lithographic illustrations, two of which relate to the detection of oleomargarine, and show the stellated crystals of lard as seen under the microscope. On p. 6, same bulletin, the following appears: "Aware of the fact that all artificial butter was made directly from crystallized fats, I devised a method by which it could be distinguished from true butter. . . . To carry out this plan, I used the low powers of the microscope with Nicols prisms. In this way I found that I had a method of detecting the crystals, whether in perfect starry form or as fragments of these forms, exhibiting all the colors of the rainbow."

In public debate at the late meeting of the American society of microscopists, at Chautauqua, N.Y., I said that all the convictions obtained in the courts of Washington, D.C., on my evidence, had been founded on my detection of lard or beef-fat in the fatty compounds sold as butter. Thus, first and last, my most important test has been the detection of crystals of foreign fats in butter substitutes sold as pure butter.

On p. 224, *Science* observes further: "Prof. H. H. Weber, however, upon testing the method described by Dr. Taylor, found, that, although the so-called butter crystals could be readily prepared from butter, they could be as readily prepared from beef-fat, or mixtures of beef-fat and lard, under like conditions." Answer: According to Professor Weber's own statement (see bulletin 13 of the Ohio experiment station), he did not use *beef-fat*, but a substance known to the trade as 'oleo,' said to be a manufactured product, containing a much smaller proportion of stearine and palmatine than does beef-fat, and made purposely by oleomargarine manufacturers to resemble butter as nearly as possible in its chemical composition. The professor triturated this butter-like substance with salt and water, boiled it, and when it was cooled discovered that it formed into globose bodies showing a cross; and he says that the crystal thus formed cannot be distinguished from that of pure butter. In this the professor is greatly mistaken. When 'oleo' crystals are observed under a half-inch objective, they can at once be distinguished from butter by their highly spinous character. But, I ask, what bearing has this experiment upon the question of my method of detecting oleomargarine? since crystals resembling those of boiled butter are never found in oleomargarine or butterine as sold.

Science further says (second paragraph): "After the publication of these results, the 'butter crystal' and its Saint Andrew's cross were relegated to a subordinate position." Answer: The Saint Andrew's cross of butter has never been and cannot be 'relegated' from its original position, viz., that of a constant factor of the globose butter crystal; nor can it be used as a means of detecting crystals of lard or of beef-fat in oleomargarine. Pure *unboiled* butter never exhibits either globose or stellar crystals, while oleomargarine and butterine, as sold, show the crystals of fats foreign to butter. *Science* says further: "Dr. Taylor insisted that his most important test has been neglected, viz., the appearance of the unboiled material under polarized light with selenite plate. According to Dr. Taylor, butter shows a uniform tint, while lard and tallow show prismatic colors." Answer: The assertion that the above is my most important test is found nowhere in my writings. In my open letter to Professor Sturtevant of the New York experiment station (March 21, 1886), I say: "The crystals of lard or of tallow generally observed in great numbers are easily distinguished from the mass of amorphous fats with which they are combined. This is one of my most important tests of oleomargarine and butterine." My assertion, 'This is one of my most important tests,' is thus made the foundation of a statement that something else is my most important test. In my publications relating to the detection of oleomargarine, from 1879 to the present time, I have reiterated the necessity of finding in the suspected material crystals of foreign fats in order to prove beyond a doubt its spurious character. *Science* further says: "Here again, however, he [Dr. Taylor] has been pursued by Professor Weber, who shows that either butter-fat or lard or tallow, when cooled quickly, will show a uniform tint, while if cooled slowly, so as to admit of the formation of larger crystals, prismatic tints are shown by both. Since imitation butter is . . . liable to undergo sufficient changes of temperature after manufacture to allow of a partial re-crystallization, the test is plainly fallacious." As regards the first sentence of the above quotation, it may be stated that *large crystals* of *butter* can never be found in unboiled oleomargarine, from the very nature of its manufacture, since the only butter it contains is derived from the milk with which it is churned. In the manufacture of butterine, however, butter, melted at the lowest possible temperature, is added to liquid 'oleo' and 'neutral lard' and churned. Even in this case the butter does not crystallize. Were the butter melted at a high temperature, its odor and taste would be objectionable; it would also crystallize in large globose forms, giving the butterine the granular appearance of lard, which would render it unsalable.

In the latter sentence of the above quotation, *Science* acknowledges that imitation butter is liable to undergo sufficient changes of temperature after manufacture to allow of a partial re-crystallization. For years past I have been endeavoring to convince

those interested in this subject of this very fact thus acknowledged by *Science*. But be it remembered, that, in the re-crystallization that takes place after manufacture, it is not the 'oleo' crystal with cross that re-appears, but a stellated body resembling lard. Normal butter always shows a uniform tint; lard and tallow, as sold everywhere, show prismatic colors. What Professor Weber alludes to is strictly neither lard nor tallow, but a specially prepared material known as 'oleo' and 'neutral lard.' These he chills suddenly to prevent crystallization, a condition not suggested by the broad statement contained in my paper. No unbiassed mind would compare the evanescent results of this experiment with an ounce of 'neutral lard' or 'oleo,' with the constant crystalline condition of the million of pounds sold daily in our markets.

With regard to the optical test of oleomargarine observed in the use of polarized light and selenite plate, I have said: "If the sample is submitted to the action of polarized light and selenite plate, and appears of a uniform color according to the color of the selenite used, we have another *indication* that the substance is *pure normal butter*, which, under these conditions, never exhibits prismatic colors. Sometimes large crystals of salt cause the appearance of prismatic colors in pure butter, by refraction: these should be removed. Butter that has been exposed to light until it is bleached, or butter that has been in immediate contact, for a long time, with a substance that absorbs its oil, as when placed in wooden tubs, has undergone a chemical change, and should not be considered as normal butter" (extract from the Sturtevant open letter, which Professor Weber professes to have reviewed). But even butter of this description never exhibits crystals resembling those of either lard or 'oleo.' The prismatic colors of an abnormal butter, described by Professor Weber, and accounted for by me in my earlier papers as observed in decomposing or over-heated butters, etc., could not be mistaken by any but a novice for the gorgeous tints seen, with and without the aid of selenite plate, in butter substitutes in general. In a letter addressed to me, April 8, current year, Professor Sturtevant says: "Your claim for the selenite plate received our attention a long time ago, as we observed it in Professor Wiley's report for 1884. This test seems to offer promise of value." Professor Wiley, chemist of the department of agriculture, says: "Pure unmelted butter, when viewed through a selenite plate by polarized light, presents a uniform tint over the whole field of vision. On the other hand, butter substitutes give a field of vision mottled in appearance. This phenomenon is so marked, that, with a little experience, the observer will be able to tell a genuine from an artificial butter with a fair degree of accuracy. While the examination should never stop with this optical test above, it can be advantageously used as a preliminary step." My bulletin was issued in 1884; the agricultural report for 1884 was issued in 1885.

In a footnote to my paper already mentioned (Hitchcock and Wall's *Journal*), the following appears: "Well-made oleomargarine may be quite free from any crystalline appearance, at least while fresh. . . . The sudden cooling on ice seems to prevent the immediate formation of crystals, but it is not unlikely that these will gradually form in course of time." Thus it is shown that Professor Weber was anticipated by seven years in this case. A tub of fresh oleomargarine, direct from Armour's factory, Chicago, the present month, was examined as soon as received. Stellated crystals were at once observed in it, and the entire field was covered with prismatic colors.

Professor Weber states that a sample of butter subjected to heat and cold in his laboratory, but which did not actually melt, showed under the microscope prismatic colors, and he pointedly, although mistakenly, asserts that this butter fairly represents the condition of butter generally. In a paper read before the American society of microscopists, August, 1885, published in the Proceedings of the society, I say: "When oleomargarine or butterine is newly made, crystals of fat are seldom observed in it when viewed under the microscope; but in course of time, owing to its being subjected to light and increase of temperature in stores, it exhibits crystals of fat more or less. In butter substitutes of commerce the crystals are seldom absent."

Science further says: "Apparently, Dr. Taylor prepared his annual report with these results in mind, for there, and in his paper before the annual meeting of the American society of microscopists at Chautauqua, Aug. 10–16, he gives his method a still different exposition." Answer: The most important part of this sentence, to me, is its personal character. It contains an indirect charge that I so altered my official report to the commissioner of agriculture as that it might appear that I had anticipated Professor Weber in his novel views and experiments. It is sufficient to say that my official report was placed in the hands of Colonel Nesbit, chief clerk of the department of agriculture, at least six months before Professor Weber made his experiments. The points to which *Science* alludes are all contained in my report to Professor Kellicott, secretary to the American society of microscopists, at Buffalo, N.Y., sent him by mail Oct. 7, 1885, and were not afterwards altered by me, as the publishing committee will testify. Independently of all this, there is on file in the department of agriculture a copy of my original report, made by one of the clerks of the statistical bureau, over one year ago, which agrees with my published official report. *Science* further says: "Dr. Taylor's first step is now to search for fat crystals in the test sample by plain transmitted light." Answer: As has been shown, this was my method for the first several years, for the simple reason that lard crystals are by this means easily detected, but I subsequently discovered that the crystals of beef-fat could not be properly defined without the aid of polarized light. *Science* further says: "By the application of polarized light, 'amorphous crystals,' whatever these may be, may be detected." Answer: I have applied this term, 'amorphous crystals,' to mottled fats which, seen by polarized light without selenite, exhibit no particular form or structure, but, seen by polarized light with selenite plate, exhibit specks and prismatic colors, thereby showing their crystalline condition. *Science* further says: "To determine whether these amorphous crystals are of beef-fat or of lard, the sample is boiled and slowly cooled, as already described, and mounted in oil." Answer: In my official report I say: "Having *first* examined the suspected material under the microscope, it may be boiled." The precaution of a preliminary examination by polarized light is highly necessary, for, should the sample contain a large per cent of butter, boiling might cause it to crystallize in large globose bodies,

by which the small crystals of lard and other fats might be absorbed and thereby escape detection. In the case of a true oleomargarine, which consists almost wholly of 'oleo,' the process of boiling would develop beef-fat crystals without cross, which would not be modified in form by the small quantity of butter in the compound.

Science further says: "Under these conditions, he now finds, in accordance with Professor Weber, that butter, lard, and beef-fat all give globular crystalline bodies which (apparently with the exception of lard) show the St. Andrew's cross." Answer: *Science* is misinformed in this case. The above statement is not in accordance with the facts. Professor Weber's language, in bulletin 13, is: "The butter revealed a well marked black cross;" "the lard, small irregular stellated bodies;" "beef-fat, only small stellate crystals." The last is an erroneous description of beef-fat, however, which has a branched and foliated crystal. It must be confessed that Professor Weber has an odd way of 'corroborating' the correctness of my experiments, — employing 'oleo oil' instead of rendered beef kidney fat, according to the statement in my 'abstract.' 'Oleo,' a substance not mentioned in my experiments, is no more beef-fat than phenic alcohol is coal-tar, although the one is a product of the other. *Science* says: "The above account of Dr. Taylor's method, as at present described by him, is drawn mainly from his last annual report to the commissioner of agriculture." Answer: *Science* is in error on this point. The points referred to by *Science* are taken mostly from my open letter to Professor Sturtevant, and from Professor Weber's bulletins 13 and 15, of the Ohio experiment station. My method of detecting oleomargarine has nowhere appeared in the columns of *Science*, nor in the reports of Professor Weber. My official report for 1885 was not issued when Professor Weber published the paper of March 1, 1886, nor does he seem to have been aware of my other publications mentioned in this paper. In point of fact, Professor Weber, unfortunately, undertook to discuss my method of detecting oleomargarine, by reviewing an abstract that did not so much as mention the subject. In conclusion, *Science* says: "We shall endeavor to keep our readers informed of the changes which the method undergoes in the future." This last is to me the most gratifying sentence in the whole article.

Thomas Taylor, M.D.,
Microscopist, U.S. dept. of agric.

Anemometer exposure.

I have been allowed space in recent issues of *Science* to call attention to errors which may arise from the position of thermometers and barometers relative to surrounding objects: may I now call attention to similar errors which may arise from badly placed anemometers? The subject is not a new one, but I wish to urge the necessity of a more uniform exposure than that now used by our signal service. According to the Associated press reports of the storm of Oct. 14 and 15 in the lake region, the wind tore through the trees of the Chicago public parks, on the morning of the 14th, with the fury of a hurricane, twisting saplings off and hurling them over the tops of large trees, littering the streets with broken trees and shattered sign-boards, and demolishing at least two buildings; and all this, according to the same despatch, while the wind was "blowing with a velocity of 20 miles an hour." Similar reports came from surrounding towns. The production of all this damage by a 20-mile wind seemed so absurd that I wrote to the signal officer at Chicago for the observed wind velocities on Oct. 14, and received the following: "Oct. 14, 1886, max. vel. of wind, S.W., 27 at 12.58 P.M.; vel. at 7 A.M., S.E., 11; at 3 P.M., S.W., 28; at 11 P.M., S.W., 11." Wind velocities of 40 miles per hour are not unfrequently recorded in Boston. On Oct. 31 the anemograph at the Boston signal office showed a maximum velocity of 40 miles, and on April 6 a maximum velocity of 51 miles; yet in neither case was there any record of broken or overturned trees and injured or wrecked buildings. This seems to show that wind velocities reported from Boston cannot be compared with wind velocities reported from Chicago. Not only can we not compare two stations of the signal office together, but we cannot compare wind velocities obtained during different years at the same station. During recent years high wind velocities have been much more frequently recorded at the Boston signal office than previously, and we find that while the average monthly wind movement at Boston from 1870 to 1881 was 6,630 miles (see Report chief signal office, 1883), the mean monthly movement during the last two years has been 8,120. Are we hence to conclude that Boston is becoming a windier place? I think not. The signal office at Boston was moved from one building to another building in 1884, and since then the velocities have been higher than previously, and are no doubt due to the changed position of the anemometer. But even with a continuous exposure of an anemometer at the same place, it is doubtful, as anemometers are now exposed, whether wind velocities from different directions can be compared with one another. There are two anemometers — a Draper and a Hahl — on the tower of the observatory at Blue Hill. These rise about eleven feet above the roof of the tower and about eight feet above the parapet. The Hahl anemometer is situated on the south side of the tower, and the Draper on the east side of the tower, which is sixteen feet in diameter. During the last three months there have been seventeen days on which the prevailing wind was from the west; and on all of these except four the total daily movement shown by the Hahl was larger than that shown by the Draper. On these seventeen days the average daily movement shown by the Hahl was 438 miles, and by the Draper 426. During the last six months there has been ten days on which the prevailing wind was from the north, and on all but three the Draper recorded more than the Hahl. On these ten days the average daily movement shown by the Draper was 353 miles, and by the Hahl, 346. This seems to show that wind velocities from different directions recorded by either instrument cannot be compared with each other, though the differences in this case are not large. Yet I think the Blue Hill anemometers are better exposed than many of those of the signal service which are near the edge of tall buildings, and have an abrupt descent on one side of them, and a long roof or series of roofs on the other.

As a sequel to this, I might call attention to the large errors which may arise from the bad exposure of the signal service rain-gauges on roofs, but I think this is generally recognized.

H. Helm Clayton.

Blue Hill meteor. observ., Nov. 10.

Recent Proceedings of Societies.

Academy of natural sciences, Philadelphia.

Nov. 9. — Prof. John A. Ryder exhibited drawings of the embryo of the paradise fish, Macropus venustus, and, in connection therewith, answered strictures of a recent English writer on his investigations regarding the buoyancy of fish eggs. It had been asserted that he attributed the buoyancy of certain pelagic ova to the presence of oil globules, whereas he had distinctly asserted that the oil drops were not the cause of the buoyancy of the cod's eggs, a statement which his critic had overlooked. On the other hand, the total volume of oil drops in the eggs of the paradise fish, which are hatched in fresh water, is one-seventh of the whole mass, and they will float, under all circumstances, until the oil is separated, when they immediately sink. In the tautog the eggs are buoyant, although there are no oil drops present. A series of drawings was exhibited, illustrating the fact that fish ova can be distinguished by the amount, color, and disposition of the oil globules. —— Dr. George A. Koenig described a mineral from the south-western part of Colorado which was at first supposed to be tin ore, but which proved on examination to be a silicate allied to black garnet or melanite. Instead of the usual one or two per cent of titanic oxide, it contains eight per cent. The conditions under which the titanium is present is yet to be determined. It probably replaces silicon with four equivalents, and aluminum with three. The mineral occurs in irregular masses in a greenish matrix, which is also somewhat abnormal in composition, and may be a new species. —— Dr. Dolley referred to a description of a supposed sense-organ in Porpita, a small button-like organism allied to the jelly-fishes, published by Conn and Beyer in the Studies of Johns Hopkins university. The speaker had gone carefully over their work, and had found that the so-called sense-organ is merely a mucous gland furnishing a plentiful secretion, which is poured over the tentacles with the effect of entangling the organisms on which the animal feeds. —— Mr. John Ford exhibited some remarkably fine specimens of the bloody clam, Arca pexata, from Greenwich Bay, illustrating the fact, which he had before announced, that the species increases in size as it goes north and east. A fine suite of specimens of Pecten concentricus, also from the New England coast, was shown and described. The mature shells are always found in one or two fathoms of water, and are taken in large numbers by the fishermen with tongs. Mr. Redfield stated that the muscles of the Pecten, known as scallops in the market, which were served at the tables of Mount Desert, were larger than those served in New York, and were procured from the Pecten magellanicus; the concentricus, according to Mr. Tryon, not being found north of Cape Cod. —— Professor Heilprin stated that Pectens collected on the coast of Florida hopped about after being taken from the water, as do cockles. The motion might be due to the violent expulsion of air from between the valves. He had been informed at Nantucket that the scallops migrate in large numbers, and that they and the star-fishes appear and disappear at the same time. —— The death of John S. Haines, on Nov. 4, was announced. He was the son of Reuben Haines, who was the corresponding secretary of the academy from Feb. 15, 1814, to December, 1831. The death was also announced of Charles C. Phillips, a member.

Calendar of Societies.

Institute of social science, New York.

Nov. 11. — Robert B. Porter, A practical view of protection, which was discussed by Messrs. E. J. Donnell, Graham, McAdam, and Dr. Van Buren Denslow.

Nov. 25. — Edward G. Clark, The basic law of ownership.

Biological society, Washington.

Nov. 13. — Filip Trybom of Stockholm, Recent progress in zoölogy in Sweden; J. W. Chickering, jun., Travels in Alaska; W. H. Dall, Historical notes on the department of mollusks of the U. S. national museum.

Torrey botanical club, New York.

Nov. 9. — J. S. Newberry, The food and fibre plants used by the North American Indians.

Brookville society of natural history, Brookville, Ind.

Nov. 9. — Edw. Hughes, Some habits of the ant lion; E. R. Quick, Biographical sketch of Rufus Haymond; O. M. Meyncke, Some introduced plants and a supplemental list of Franklin county plants; A. W. Butler, Arvicola riparius, a destroyer of sweet-potatoes and other root-crops, with notes on the late breeding of the species.

GEOLOGY, CHEMICAL, PHYSICAL, AND STRATIGRAPHICAL. By Joseph Prestwich, M.B., F.R.S., F.G.S. Correspondent of the Institute of France, Professor of geology in the University of Oxford. In two vols. Vol. I.: Chemical and Physical. 8vo. $6.25. (Oxford University Press.) Macmillan & Co., Pubs., New York.

THE STANDARD NATURAL HISTORY. By all the leading American scientists. Edited by J. S. Kingsley, Ph.D. Vol. I. Lower Invertebrates. Vol. II. Crustacea and Insects. Vol. III. Fishes and Reptiles. Vol. IV. Birds. Vol. V. Mammals. Vol. VI. Man. 6 vols., nearly 2,500 illustrations and 3,000 pages. Imp. 8vo, cloth, $36.00; half morocco, $48.00. S. E. Cassino & Co. (Bradlee Whidden), Publishers, Boston.

THE BUTTERFLIES OF THE EASTERN UNITED STATES. For the use of classes in zoölogy and private students. By G. H. French, A.M. Illustrated by 93 engravings and a map of the territory represented. Large 12mo. Cloth. $2.00. J. B. Lippincott Company, Pubs., Philadelphia.

LIPPINCOTT'S BIOGRAPHICAL DICTIONARY. A new, thoroughly revised, and greatly enlarged edition. A universal pronouncing dictionary of biography and mythology. Containing complete and concise biographical sketches of the eminent persons of all ages and countries. By J. Thomas, M.D., LL.D. Imperial 8vo, 2550 pages. Sheep. $12.00. J. B. Lippincott Company, Pubs., Philadelphia.

WILSON. — AMERICAN ORNITHOLOGY; or, The Natural History of the Birds of the United States. By Alexander Wilson. With a life of the author, by George Ord, F.R.S. With continuation by Charles Lucien Bonaparte (Prince of Musignano.) POPULAR EDITION, complete in one volume with 385 figures of birds. Imp. 8vo. Cloth, $7.50. Half Turkey mor., $12.50. Porter & Coates, Philadelphia.

THE INTERNATIONAL CYCLOPEDIA. The best for popular use and specially adapted for ready reference. Fifteen royal 8vo volumes. 13,206 pages, 49,649 leading titles. Sold only by subscription. *Capable salesmen wanted.* Dodd, Mead & Co., Pubs., New York.

ANNALS OF MATHEMATICS. Edited by Ormond Stone and William M. Thornton. Office of Publication: University of Virginia. $2 per vol. of 6 nos.

SCIENCE ECONOMIC DISCUSSION. A controversy between the adherents of the old and new schools of political economy regarding their main points of difference, by Henry C. Adams, Richard T. Ely, Arthur T. Hadley, E. J. James, Simon Newcomb, Simon N. Patten, Edwin R. A. Seligman, Richmond M. Smith, and Frank W. Taussig. 12mo. Paper, 50 cts. Science Company, Pubs., New York.

MAMMALS OF THE ADIRONDACKS. By Dr. C. Hart Merriam. Contains an introductory chapter treating of the location and boundaries of the region, its geographical history, topography, climate, general features, botany, and faunal position. This work consists, in the first place, of a general account of the prominent features of the Adirondack region; and, secondly of a popular narrative of the habits of the animals found within its confines. Imp. 8vo. $3.50. Henry Holt & Co., New York.

SCIENCE.—SUPPLEMENT.

FRIDAY, NOVEMBER 19, 1886.

EXPERIMENTAL PSYCHOLOGY IN LEIPZIG.

THE period in the development of a science at which observation is supplemented by experimentation has long been recognized as one of critical importance. Moreover, if the nature of the science thus advanced seems to be such that the employment of the new instrument is followed by the positing of a more complete and scientific stand-point; if, in other words, the influence of the experimental stage is as valuable for theory as for practice, — the importance of this step is certainly increased. There are many men now living who could have witnessed the beginnings of this movement in psychology, and lived its life with their own. Notwithstanding the great enthusiasm with which this departure was hailed, — an enthusiasm which in its short career has experienced many ups and downs, — the study has been taken up more largely as an avocation than as a serious life-work. Many scientists, mostly physicists or physiologists or alienists (Helmholtz, Mach, Hennig, Preyer), have taken up the limited portion of the subject in which they were most interested, and devoted themselves to it. The greatest advances of any have undoubtedly resulted from the labors of such men. On the other hand, the propounders of psychological systems have not been slow in incorporating the results and conceptions of the new movement into their doctrines, not always, it may be added, with a very congruous result. But there are many indications that an essential condition of the flourishing of scientific psychology is the existence of specialists devoted to its cause, with all the advantages, both material and intellectual, that their position in a first-class university can bring. Psychology is ready to emerge from the nomadic state; and, having given assurance of its permanency, it asks for a home, or rather for homes. The University of Leipzig, owing to the efforts of Professor Wundt, has been, perhaps, the foremost in answering this call. Many young men have gained an impetus for such work under his direction; and a quarterly *Philosophische studien*, devoted mainly to the publication of results of research in the Leipzig laboratory, was founded some years ago. The articles relating to experimental topics in the last two numbers of this journal[1] will indicate the direction in which work is being done.

A very interesting study is that on the 'Memory for tone,' by Mr. H. K. Wolfe. The impetus to the research was given by the admirable study of the memory by Dr. Emminghaus, in which he counted the number of repetitions of a series of nonsense-syllables necessary to enable the hearer to repeat the series from memory at once or after a certain interval. He found, for example, that he could repeat seven such syllables when read to him but once; if there were twelve syllables, they would have to be repeated sixteen times, and if twenty-four syllables forty-four times before they were memorized. Mr. Wolfe very justly remarks that what is here understood by memory is the power to reproduce, and that there is a more simple and retentive form of memory, which consists in the power to recognize as familiar an object that has been presented to the senses before. A very common illustration of this is seen in the fact, that, on reading a book a second time, we recognize a great deal more of it than we could have told of it. So, too, we can recognize at least ten times as many shades of color as we can see in the imagination, can understand more words than are in our usual vocabulary; and so on. It is this simpler form of memory that Mr. Wolfe studies. A series of nearly 300 vibrating metal tongues, giving the tones through five octaves, from 32 to 1,024 vibrations, was at his disposal. These tongues gave tones differing by 2 vibrations only in the two lower octaves, and by 4 vibrations in the three higher octaves. In the first series of experiments a tone was selected, and, after sounding it for one second, a second tone was sounded, which was either the same as the first, or different from it by 4, 8, or 12 vibrations in different series. The person experimented upon was to answer whether the second tone was the same as the first, thus showing that he recognized it, or whether it was different, and, if so, whether it was higher or lower. Of course, the interval of time between the two tones was an important factor. The proportionate number of correct judgments, and the smallness of the difference of the vibration-rates of the two tones, would measure the accuracy of the tone memory. It appeared that one could tell more readily whether the two tones were alike than whether they were different,

[1] *Philosophische studien.* Herausgegeben von WILHELM WUNDT. Band III. hefte 3, 4. Leipzig, *Engelmann*, 1886. 8°.

although in both cases the accuracy of the memory was remarkably good.[1] When the tones were really equal, they were recognized as such, on the average, in from seventy-five to eighty per cent of all cases. In using tones differing by only 4 or 8 vibrations, though the difference was very often clearly perceived, the direction of it, whether higher or lower, was not always clear, and even in differences of 12 vibrations there was little confidence in one's judgment. This seems to be a peculiarity of auditory sensations: for in sight you can almost as readily say that a shade is lighter or darker than another as that it is different; you can almost as soon detect the direction in which a point is moving along the skin as you can detect the motion itself. But the main point is the effect of the time-interval between the tone and its reproduction. This was varied from 1 second to 30 seconds, or even to 60 seconds, or 120 seconds in some experiments. The general result is, that the longer the interval, the smaller the chances that the tone will be recognized; and this process of forgetting takes place at first very rapidly, and then more slowly. It is made probable that the interval must increase in a geometrical ratio to produce an arithmetical series of (approximately) equal degrees of forgetting; i.e., the curve is logarithmic. This law is subject to considerable variations, one of which seems to be constant and is peculiar; namely, there seems to be a rhythm in the memory itself, and, after falling, it recovers slightly, and then fades out again. Among other results were that the accuracy of the memory decreases as the pitch of the tone is lowered (within limits); that relatively high tones tend to be judged too high, and low ones too low, by unmusical ears; that the effect of practice is at first marked, but soon diminishes as is its general law; and that the recovering power of the ear is so great that fatigue has little effect. To prove the last proposition, experiments were made for one day from 8 A.M. to 7 P.M. (with ten minutes intermission).

A subject that has always received great attention at the Leipzig laboratory is the measurement of the time of psychic processes. These have been conveniently divided into three kinds: 1°, the reaction time, which is simply the time after the application of the sense-stimulus necessary for an individual to record the fact that he has received the sensation; 2°, the distinction or perception time, which is the additional time necessary for him to appreciate the nature of the sensation, e.g., whether a light was red or blue; 3°, the choice or will time, which is the additional time necessary to react in a certain way on the reception of a certain sensation, e.g., to press a key with the right hand when the red light appears, with the left hand or not at all for the blue light. Dr. J. M. Cattell, in a recent re investigation of a large part of the field, has brought to notice several new facts, and has improved the method in many respects. To insure himself against any variations in the working of his apparatus, Dr. Cattell devised a means of controlling it, an essential part of the device being the determination of the most suitable strength of current for running the chronoscope. The time is recorded on a Hipp chronoscope, which, by the release of a magnet and the springing back of the same, records intervals of one one-thousandth of a second. A falling screen, at a point in its fall, suddenly reveals a card or color, if that is the sense-stimulus, or can convey a shock to the finger, etc., and at the same time releases the magnet of the chronoscope, and sets the hands of the clock in motion. The reaction of the observer is made either by closing a key connected with the chronoscope with his hand, or by speaking through a tube, which, like the hand-key, has the effect of instantly stopping the clock. One can then read on the chronoscope the interval of time between the two events. In this way it was found, as the result of 520 experiments on each of two observers extended over a period of six months, that the reaction time for daylight, reflected from a white surface, was quite constant, and was about .149 of a second (strictly, .151 of a second for one, .147 of a second for the other observer), it being immaterial whether the reaction was made with the right or the left hand. But it takes .030 of a second longer to record the reaction by moving the lips. It is usually considered that the state of the attention has most effect on the reaction time; but Dr. Cattell found that the disturbance caused by the ticking and ringing of metronomes with bell attachments affected the reaction very slightly indeed, and explains this divergence from the results of other experimenters, by the unusual amount of practice which he had in such experiments. In other words, the process was too automatic to be affected seriously by the attention. Again: if the attention be distracted by the mental operation of repeatedly adding 17 to a series of numbers, the time is more seriously lengthened; and, if the observer makes a great effort to attend, the time can be slightly shortened. He also shows that this extreme state of attention can be main-

[1] Very unfortunately, Mr. Wolfe, in tabulating his results, has worked upon a false mathematical process, and has thus made it impossible to draw conclusions regarding the recognition of the fine intervals of tone. From the original records such conclusions could be drawn. I am thus forced, on this account, to speak only of the recognition of equality of tone, and even to make allowances in stating these.

tained for only about one second. The two observers show some individual variations, all of which indicate that the processes were more thoroughly reflex in Dr. Cattell's case than in that of his associate. It is argued that the cortex is not concerned in the reaction, and that perception and willing also have no part in it.

Passing to perception times, the observer is asked to react only if the card which the falling of the screen reveals has a white surface, and simply do nothing at all if it has a black surface. The additional time necessary to recognize the whiteness of the surface, and to send out the voluntary impulse, was for the one observer .061 of a second; for the other, .095 of a second. This time Dr. Cattell thinks should be divided equally between the two operations, because in the simple reaction the closing of the key was entirely automatic. Of course, it no longer makes any difference how the reaction is made. It, however, takes a little longer, if, instead of a white surface, a colored surface is used, though the observer has simply to distinguish that it is not black. If the color is to be distinguished, and in each case can be one of two colors, then the perception-and-will time was .100 and .110 of a second respectively for the two observers; if the color can be one of ten colors, .105 and .117 of a second. In other words, it takes about .0058 of a second longer to distinguish one of ten colors than one of two, but .033 of a second longer to say what the color is than to say it was not black. In a similar way, if two letters are to be distinguished from one another, instead of two colors, the time is lengthened by about .038 of a second. If a letter is to be distinguished out of ten letters, it matters greatly what the letter is. E is the most difficult to read. The order of difficulty of five letters experimented upon was M, A, Z, B, E. The perception time for short English words is somewhere about .142 of a second; it is slightly longer for long words and for words in a foreign language. A very important point is, that the perception time for words is only slightly longer than for letters; thus showing that the former, not the latter, is the reading unit. Finally, if small pictures of such familiar objects as a tree, hand, etc., be used instead of words, the time is found to be shorter, and is about equal to that for seeing a color. A picture is thus a simpler, less abstract sign than a series of letters.

There remains the will or choice time. We have seen in the series of experiments just described that a will time has already entered. If we change the form of experiment so that if a red light appears the right hand is to react, and if a blue the left hand, the time is lengthened by .026 of a second. In the former case the same hand always reacted; now the motor impulse is to be sent in a certain direction.[1]

A very interesting form of the experiment consists in letting the different kinds of reaction be the names of the colors, letters, pictures, or words; in other words, to measure the time necessary to read, i.e., to see and name them. Four-tenths of a second was thus found as the time necessary for reading a letter. Similarly the time necessary for reading a one-place number was found to be about .360 of a second, it taking only .033 of a second longer to read two-place numbers, and only .025 of a second longer for a three-place than a two-place number. As regards words, it was found that it took longer to read (not including pronunciation) long than short, and foreign than vernacular words. To name a short word in one's native language requires .111 of a second, which is .050 of a second less time than it takes to name a letter; thus showing, that, as we constantly read words and seldom letters, the association between the concept and the name is much closer. An interesting result as regards color is this: that, while it takes less time to perceive a color than a letter or word, it takes quite a long time (.343 of a second) to find the name of the color. The association between a color and its name is a loose one. The names of the more familiar colors were found in considerably less time. The average time for naming a picture is about equal to that for naming a familiar color. Familiarity is again an important factor: it took least time to name a 'hat,' longest to name a 'teapot.' By way of summary, the following table will be found convenient.[2]

Reaction time for		light	= .150 sec.
Perception time for		light	= .040 "
" " "	a	color	= .095 "
" " "	a	picture	= .105 "
" " "	a	letter	= .120 "
" " "	a (short)	word	= .125 "
Will time for colors			= .340 "
" " "	pictures		= .305 "
" " "	letters		= .155 "
" " "	words		= .105 "

There have thus been recorded the times of some of the simpler mental activities, and the understanding of the higher psychic processes has thus been made more easy. The times of these processes Dr. Cattell supposes will become shorter in the course of evolution "and we will live so much the longer in the same number of years."

Finally, a very painstaking research by Dr. Alfred Lehmann deserves mention. His object

[1] The perception process is also slightly but not materially different.

[2] The final section of the paper is devoted to showing that extreme attention can shorten central operations; that the effect of practice is first marked, but soon reaches its limit (as automatism sets in); that fatigue is not as readily brought on, and is not as disturbing a cause as is usually supposed.

was to decide whether the method of the 'mean gradations,' is applicable to the sensations of brightness. This method consists in presenting two disks composed of different proportions of black and white (and thus, when rapidly revolved, showing different shades of gray), and asking the observer to regulate the amount of black and white in a third disk until it was just as much darker than the one as it was lighter than the other: i.e., to find a gray of a mean intensity. Call the intensity of the darker one x and of the lighter one y, then the arithmetical mean would be $\frac{x+y}{2}$. But if Weber's law (which says, that to produce equal differences of sensation, the difference in the stimuli vary proportionately to the stimulus already present) is true, then $\sqrt{xy}$ would be the intensity that appears to be mean; i.e., $x : \sqrt{xy} :: \sqrt{xy} : y$. Dr. Lehmann's study is devoted to discovering all the sources of error in such an experiment. The order of the disks, whether the variable disk should be between the two or not; the direction and kind of illumination; the order of experimenting; and, beyond all, the effect of contrast with the back-ground against which the disks were seen, — were all taken into account. Dr. Lehmann succeeded in measuring quantitatively the effect of contrast (a very valuable result), applied a method of eliminating its effect, but finally comes to the purely negative conclusion that the question of the validity of Weber's law is not favored or refuted by his experiments. A real test still remains to be made. His most valuable result is the study of the great effect of contrast in all such work.

Joseph Jastrow.

PROCEEDINGS OF THE ENGLISH SOCIETY FOR PSYCHICAL RESEARCH.

To allay at once any feelings of expectancy (which some readers may share with the writer whenever the green cover of a new number of these 'Proceedings' is caught sight of) it may be well to say that nothing unusually wonderful is therein revealed. A considerable portion of the number is devoted to the 'physical phenomena' connected with spiritualism. Fortunately, throughout most of the discussion the subject is strictly adhered to, and any theory of explanation involving assumptions contradictory to the principles of physical science is considered irrevelant. The issue is, in the main, considered to be whether certain strange phenomena are explicable by what we know of conjuring, mal-observation, and the psychology of belief, or whether they must be transferred to the category of the unexplained, to be reserved for future study. Can we say 'yes' or 'no' to this alternative, and if not, which of these answers is pointed out as the more probable?

Professor Barrett opens the discussion, and at once records his conviction, "that, at any rate, some of the simpler phenomena of spiritualism are inexplicable by any causes at present recognized by science." This conviction is not due to experience gained in the ordinary public seances; that is considered as largely fraudulent, and evidently worthless. But attention is called to a few cases of private mediumship, in which all the conditions necessary for a scientific test were granted. In the first of these cases, a girl of ten years had the peculiar gift of causing raps to be heard, even when her hands and feet were firmly held; the raps occurred at certain letters of the alphabet, and displayed a childish intelligence. A word "was misspelled by raps, exactly as the child would have misspelled that word." Professor Barrett concludes that he is 'morally certain' that hallucination, trickery, or known causes had nothing to do with it, but that it belongs to a 'class of phenomena wholly new to science.' A case is then cited in which a clever boy deceived his father (a distinguished surgeon) and all his family, by pretended spiritualistic manifestations, for a whole year; but the 'radical' difference is pointed out that in this case the trick was discovered, in the former case it was not. Professor Barrett, with another private medium, saw tables move, and raps spell out 'pious platitudes,' "such as the medium herself (a Methodist) would be likely to concoct," and again considers the phenomena as inexplicable. A seance with a paid medium, Mr. Englinton, added to the mystery. Whether further study will support this conviction or not, at any rate, says Professor Barrett, more light can be shed on these phenomena by occasionally assuming the possibility of the spiritualistic stand-point; theorizing is needed as well as observation.

The paper of Mrs. Henry Sidgwick reports an unusually able investigation of the so-called spiritualistic phenomena. It is the account of an observer who knows how enormous the possibilities of deception, of mal-observation, and how insidiously inference usurps the place of perception. Every one interested in the psychology of illusions should read this admirable exposition of an interesting chapter on that subject.

The phenomena to be explained include raps, levitation of objects, playing on musical instruments, psycography and so on. Mrs. Sidgwick speaks from a twelve years' experience with mediums, including several of considerable fame. As

Proceedings of the English society for psychical research. Part x, Oct., 1886. London, *Trübner.*

regards raps, one must remember that as early as 1851 it was shown that these could be and were produced by voluntarily dislocating the knee-joint. Holding the knees of one of the original Fox sisters was sufficient to prevent the appearance of the raps. It will be impossible to detail the many devices to prevent fraud of which Mrs. Sidgwick availed herself; but the reading of these extends one's appreciation of the conjuring art. Perhaps the most ingenious device was that of placing the medium in a hammock connected with a spring-balance which recorded the weight of the hammock and its contents. If the medium herself personated the 'materializations,' her stepping out of the hammock would be recorded. "The seances were nearly unsuccessful until the last." In the apparently successful ones an associate was in the cabinet for a time, and broke her promise by refusing to be searched when leaving it. In short, remembering that nearly every medium who pretends to any very remarkable manifestation, has been exposed at some time of his or her career; that the conditions which they prefer are those most available for trickery; that when the conditions are rigid and unexpected, success is rare (if it ever occurs): that the kind of feats by which the spiritualists choose to prove their theories are exactly the kind which a conjurer chooses, — in view of all this, the aversion of scientific men to investigate such phenomena is largely justified. The most (perhaps the only) valuable result of this research is, as was said above, the light it throws on the psychology of belief, and, from a natural-history point of view, the willingness of a certain class of humanity to be deceived and to long and search for the philosopher's stone.

Mr. C. C. Massey contributes a paper on the possibilities of mal-observation in the evidences of spiritualism, in which he maintains that these possibilities have been greatly exaggerated, and that, if we simply take the precaution of recording one simple observation at a time, human testimony is reliable enough. Mr. Massey (who is the translator of Zöllner's 'Transcendental physics') then attempts to show, by recounting seances with notorious mediums, that reliable evidence for the existence of obscure forces exists in abundance. The former president, Mr. Sidgwick, very properly adds a note that the policy of a psychic research society, far from encouraging this not over-moral trade, should distinctly be averse to having more to do with it than is necessary.

Two papers by Mr. Frederic W. H. Myers deserve some notice. The first treats of "Human personality in the light of hypnotic suggestion," and is a very exaggerated estimate of the evidence which this condition can furnish with regard to the nature of the eye. The main idea is, that the subject almost always resists the notion that anything but his own free choice determined the suggested action, and will invent the most fanciful explanations to make an absurd action appear rational. In other words, one may even have the feeling of acting as a free agent, and yet be constrained by a foreign agent, — a fact, by the way, well known to Spinoza. The object of the second paper is to suggest that telepathy may be operative hypnotism; that a subject may be put into this condition by the will of the operator himself a quarter of a mile or more away. The evidence produced is far from satisfactory, owing, in part, to the fact that the observers who were sent to find out whether the sleep followed would themselves unconsciously furnish the suggestion. Mr. Myers then proposes a serial classification of the methods of 'hypnogeny,' beginning with such massive disturbances as cause cataplexy in animals, and gradually leading up to this new 'telepathic' hypnotism. The scheme is in part suggestive, but is premature, and adopts as proved, facts extremely uncertain and improbable. The theoretical portion of the paper is extremely disheartening; such a sentence as "that perhaps when I *attend* to a thing, or *will* a thing, I am directing upon my own nervous system actually that same force which, when I direct it on another man's nervous system, is the 'vital influence' of mesmerists, or the 'telepathic impact' of which Mr. Gurney and I have said so much," certainly smacks of anything but a scientific spirit.

Mr. Myers, Mr. Gurney, and Mr. Podmore will very shortly give a detailed statement of their psychical researches, in a two-volume book, 'Phantasms of the living,' and to this work Mr. Myers refers readers for further information.

The present writer can not refrain from asking, if all the brains, the labor, the money, and the time devoted to these investigations by our English cousins have yielded such meagre results, and have led the way to so much useless and markedly perverted thinking, whether, as long as the world has so many important questions waiting for a decision, so much good cogitative energy should be allowed to go waste.

RECENT WORKS ON TOPOGRAPHICAL SURVEYING.

THE field work of the topographer consists of two parts, which are entirely distinct in character. These are, first, the work of location, which may be done entirely by angulation, or by angulation and distance measurements. It is geometrical

work. This work of location serves only to correct the map; it forms no part of the map itself. The matter of the map is obtained by the second part of the topographer's work, that of sketching. This is artistic work. Here we come to a definition of a map from the constructive point of view. It is a sketch, corrected by locations. The more locations per square inch of the map, other things being equal, the better the map; but however numerous the locations may be, the map itself is none the less a sketch.

Locations are effected in two ways, as noted above. First, by angular measurement, starting from a carefully measured base. These measurements may be made with the theodolite or plane-table. Second, by direction and distance measurements; the former by compass, theodolite, or plane-table, the latter by chain, steel tape, odometer, or stadia. These two methods are frequently used in combination, as in the ordinary work of the U. S. coast and geodetic survey, where the plane-table stations and many unoccupied points are located by angular work, while other points are fixed in position by direction and distance, from the stations, using the plane-table and stadia for this purpose.

Among topographers of wide experience in the use of instruments and methods of work, there is no question, where the conditions are favorable, as to the advisability of using the method of location by angulation, rather than that by direction and distance measurements. It is without doubt the most rapid and the most accurate method of controlling the sketches for a topographic map. Its employment requires, however, that the country shall present some relief, that it contain an adequate number of points, natural or artificial, suitable for being 'cut in,' and that it be not too generally covered with forests, in order that a sufficient number of cleared summits, well distributed for stations, may be obtained. The primary advantage in the use of the plane-table with this method, as with all other methods, is, that the work is plotted directly upon the station, and the sketch is then made upon a correct framework, — in other words, the map is made upon the station, with the country in view. The principal disadvantage, if it be a disadvantage, is that the angles, being recorded graphically, cannot be used subsequently for a map upon a larger scale. Objections to this instrument on account of its weight and cumbrousness have no force, as the plane-table may be made very light and simple without reducing its accuracy.

The theodolite may be used, the angles recorded, and the map plotted upon the station. This combines the advantages of the plane-table and the theodolite. It requires, however, more men, more instruments, and more time devoted to work upon the station, where time is of especial value. Another method of combining the advantages of both instruments is in extensive use in the western work of the U. S. geological survey. Here a light and simple plane-table is used, in conjunction with a theodolite. The map is made upon the former instrument, while with the latter, angles for location are read upon all important points. These are subsequently plotted in the office, and the plane-table sheets corrected accordingly.

The methods of continuous location by direction and distance measurements are known generally as traverse or meander methods. They are primarily applicable to the survey of lines and not of areas. The essential feature of these methods is, that one station is located from another in continuous series. There is necessarily an accumulation of error in such a series, which may be corrected by connecting the line with points in a triangulation. All these methods are imperfect in several respects. First, they are inaccurate, because of the liability to an accumulation of error. Second, they are ill adapted to the survey of areas, inasmuch as while the line (usually a road) and its immediate neighborhood are surveyed in the greatest detail, the areas between lines of survey are, in practice, comparatively poorly surveyed, and the resulting map is unequal in quality in different parts. Third, the traverse is necessarily made upon a much larger scale than is required by the scale of the map, and so the work is more expensive than it need be. The more hilly the country, the more force there is in the second of these objections, as the lines of survey, following the roads and trails, necessarily pass through the lowest parts of the country, and, therefore, the topographer, instead of being free to select the best points for overlooking his area, is obliged to content himself with the poorest outlooks. The result is seen in meaningless hill-forms, which were evidently sketched from below in the valleys. By experienced topographers, traverse methods are avoided whenever practicable, but in flat or timbered régions it often becomes necessary to adopt them.

Of the instruments used, the plane-table is ill adapted to this work, being difficult to manipulate quickly. The chain and tape are generally discarded in the survey of areas, as being more accurate than the requirements, and proportionately slower. The odometer attached to a revolving wheel measures distances with ample accuracy for almost any scale, and, in connection with the compass, allows the most rapid work of any of these methods. Measurements of height, how-

ever, must be made by a separate instrument, — by the barometer, if great accuracy is not required, or by spirit-level, if the barometer does not meet the requirements. The stadia instrument measures distance, direction, and relative height. In this combination lies its superiority to other instruments for traverse surveying. It is not, however, as rapid, as cheap, or as accurate in its measurements as the odometer. The method is new to many surveyors, and is attractive from its novelty. Extraordinary claims are made for it in regard to accuracy, which are scarcely to be realized in practice.

Until recent years, the vertical element of topography has received little attention. If recognized at all, it has been represented qualitatively only, by means of shading, either by hachures, crayon, or brush work. The U. S. coast and geodetic survey, however, from its inception, has mapped the relief quantitatively, by means of contours, but, strange to say, has in nearly all its published maps failed to reproduce this material, but has represented relief by hachures. At present the importance of showing the relief quantitatively is becoming recognized, and most modern maps have a vertical as well as a horizontal scale, the relief being represented by contours. Although this reform is now well advanced, and although the methods of surveying the vertical element are well matured, there is still much misconception among engineers in regard to these methods. Many engineers can imagine no other way of mapping the contours of an area except that of taking up each contour and tracing it in all its convolutions. That contours can be sketched with sensible accuracy over a wide area, providing the sketch be corrected by the measurement of the heights of a dozen or more key points, they are slow to believe, and the fact that the U. S. coast and geodetic survey uses this means of locating contours, only lessens their faith in the infallibility of that organization.

Among all the treatises and text-books upon topographic surveying recently published there is not one which treats the subject in a comprehensive manner. These books, in so far as they relate to field work, discuss little besides the geometrical part of the topographer's work, — the simplest and in many respects the least important, and always the most easily learned part of his profession. The artistic part of the field work is either ignored entirely or is treated as of very little importance. This is perhaps due to the difficulty of describing the almost infinite variety of the work, as it changes with each day and with every square mile. Moreover, it is a subject which can be treated with much greater facility by means of object lessons in the field than by books. The aphorism that 'topographers are born but not made,' may have something to do with this lack of facilities for making them. Another general criticism upon these books is, that, of the various methods of location, they treat only of location by traverse, and the impression constantly conveyed to the student is, that topographic work is universally done by means of traverses. A misconception regarding the use of the plane-table appears to exist in the minds of most engineers who have written upon topographic surveying. They appear to regard the plane-table solely as a stadia instrument, and criticise it from that point of view alone. There is no method of surveying to which this instrument is not applicable, and, for most kinds of work, it is the simplest, most convenient, and most accurate instrument in use. Again, these books are very unsatisfactory regarding the construction of the vertical element of maps. The impression conveyed by the treatment of this subject is, that contours should be traced upon the ground, a method never employed upon geographical surveys, as stated above.

Another generic feature of these books which is worthy of attention is, the great number and complexity of the conventional signs which they describe. In general topographic maps it is desirable to keep the number of such symbols down to the smallest possible, consistent with the amount of information which the map should contain: first, in order that the maps may be easily read; and second, that they may be easily kept up to date. Another notable omission is, the want of consideration of the scale of maps as affecting the character of the work, — a matter which involves the degree of accuracy and of detail necessary to be obtained in the survey, and, consequently, the cost of the work. It appears to be assumed that *a survey is a survey*, which may be plotted upon a larger or a smaller scale, without any regard to the quality of the material obtained. In point of fact, there is no more important question in the economics of map-making than that of scale, and the right proportionment of the work to the adopted scale. It is in this direction, more than any other, that improvement is to be expected in the conduct of work.

Professor Haupt's 'The topographer'[1] is the most comprehensive and satisfactory of the recent manuals on topographic surveying. Still, while treating with great fulness of traverse surveying, it ignores other methods of location. It makes an attempt to treat of sketching, but without much success. The chapter upon relief, drainage systems,

[1] *The topographer, his instruments and methods.* By LEWIS M. HAUPT, A.M., C.E., Philadelphia, *Stoddart*, 1886. 8°.

etc., contains numerous erroneous statements regarding geographical laws. The book is fully illustrated with cuts and maps. Most of the latter are fairly good specimens of work, but a better example of hachure work might have been selected than the map of the Yellowstone national park, while that of the Neversink mountains near Reading, Pa., is by no means a good specimen of contour work.

Mr. Carpenter's little book[1] is essentially a description of the methods of work in use upon the U. S. geographical surveys west of the 100th meridian, in which organization his experience was obtained. It is almost unnecessary to say that it deals almost entirely with traverse methods of location.

A number of text-books have been written upon stadia surveying, and many tables for the reduction of stadia measurements have been made, most of which are theoretically faulty, but all good enough for the material to be treated. Among these are Winslow's 'Stadia surveying'[2] and Johnson's 'Topographical surveying.'[3] The former contains only the theory of the instrument, with tables for its use. It is a convenient little volume. The latter goes into the subject more fully, giving the theory, describing the instruments in ordinary use, and the routine of field and office work, together with the applications of the method to railroad, canal, ditch, and pipe-line surveys, surveys of drainage basins, and city and town sites, etc. In discussing the cost per square mile by this method it will be noticed that no reference is made to scale, a fact which necessarily makes the figures of no value. Mr. Johnson discusses the relative advantages of the use of the plane-table and the stadia instrument at some length, to the disadvantage of the former, but it will be seen that he assumes that the plane-table is used simply as a stadia instrument. His concluding objection to the plane-table, viz., that it is a very difficult instrument to learn, suggests a want of familiarity with it.

Lieutenant Reed's 'Topographical drawing and sketching'[4] relates principally to the office work upon maps. A few pages are, however, devoted to field sketching and the use of instruments, but these treat of that ruder class of surveying known as reconnoissance. A chapter is devoted to the use of photography as an aid to topographic work, an idea which is very popular with amateur topographers. That portion of the work which treats of the office preparation of maps is very full, and is excellent. The book is beautifully illustrated with plates of conventional signs and examples of existing maps.

[1] *Geographical surveying.* F. DEY. CARPENTER. New York, *Van Nostrand*, 1878. 12°.

[2] *Stadia surveying.* By ARTHUR WINSLOW. New York, *Van Nostrand*, 1884. 12°.

[3] *A manual of the theory and practice of topographical surveying by means of the transit and stadia.* By J. B. JOHNSON, C.E. New York, *Wiley*, 1885. 8°.

[4] *Topographical drawing and sketching, including applications of photography.* By Lieut. HENRY A. REED, U.S.A. New York, *Wiley*, 1886. 4°.

M. VULPIAN recently communicated to the French academy the interesting results of an experiment on brain-mutilation in a fish. The cerebral lobes were removed from a carp on March 18 last, and the fish was under daily observation up to the 29th of September, when it died from causes believed by the author to be wholly unconnected with the brain injury. During all this time its movements and respirations were normal, not differing from those of its uninjured fellows. In fact, two months after the operation, M. Vulpian could not perceive any difference in its movements and behavior from those of healthy fishes. Its sight was in no wise impaired. It saw and avoided obstacles, and readily recognized the yellow and white fragments of boiled egg on the bottom of the aquarium. It struggled actively with its fellows to obtain the small particles of food thrown into the water, seeing them from a distance, and following them as they fell. At the approach of the one feeding the fishes, it would swim from the opposite side of the aquarium, manifesting no impairment of intelligence. Its sense of taste was preserved, as shown by its rejecting non-alimentary substances accidentally taken into its mouth. The sense of smell only, was destroyed, owing to the section of the olfactory processes; otherwise it seemed to retain all the senses, and the intellectual and instinctive faculties of the normal healthy fish. Upon examination, the cerebral lobes and pineal gland were found to be entirely wanting, but the rest of the brain was intact. Although nearly six months had elapsed since the operation, there was no indication of the regeneration of the lobes. The opening in the cranium closed up in about two months, and, had the fish lived a month or two longer, the author was certain that the walls would have been wholly ossified. The experiment shows that the instinct and the will — faculties which in all higher animals seem to be located in the cerebrum — are capable of their full manifestation in the fish after its complete ablation.

— Dr. Beaulieu, in the *Economiste français*, gives the following as the quantity of tobacco consumed by each 1,000 people in Europe; in Spain, 110 pounds; Italy, 128; Great Britain, 138; Prussia, 182; Hungary, 207; France, 210; Denmark, 264; Norway, 229; Austria, 273; Germany, 336; Holland, 448; Belgium, 560.